MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

Slotted Optical Switches
Darlington Output

These devices each consist of a gallium arsenide infrared emitting diode facing a silicon NPN photodarlington in a molded plastic housing. A slot in the housing between the emitter and the detector provides the means for mechanically interrupting the infrared beam. These devices are widely used as position sensors in a variety of applications.

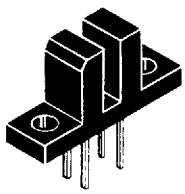
Features:
- Single Unit for Easy PCB Mounting
- Non-Contact Electrical Switching
- Long-Life Liquid Phase Epi Emitter
- 1 mm Detector Aperture Width

Applications:
Shaft encoders, non-contact switches, position sensing, paper handlers, coin handlers, and general purpose interruptive sensing.

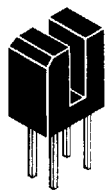
H21B1*
H21B2
H21B3
H22B1*
H22B2
H22B3

*Motorola Preferred Devices

SLOTTED OPTICAL SWITCHES DARLINGTON OUTPUT



H21B1, 2 AND 3
CASE 354A-03
STYLE 1



H22B1, 2 AND 3
CASE 354-03
STYLE 1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
INPUT LED			
Reverse Voltage	V_R	6	Volts
Forward Current — Continuous	I_F	60	mA
Input LED Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	150 2	mW mW/°C
OUTPUT DARLINGTON			
Collector-Emitter Voltage	V_{CEO}	30	Volts
Output Current — Continuous	I_C	100	mA
Output Darlington Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	150 2	mW mW/°C
TOTAL DEVICE			
Ambient Operating Temperature Range	T_A	−40°C to 100°C	°C
Storage Temperature	T_{stg}	−40°C to 100°C	°C
Lead Soldering Temperature (5 seconds max)	—	260	°C
Total Device Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	300 4	mW mW/°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
INPUT LED					
Forward Voltage (I_F = 60 mA)	V_F	0.9	1 34	1.7	Volts
Reverse Leakage (V_R = 6 V)	I_R	—	1	10	μA
Capacitance (V = 0 V, f = 1 MHz)	C_J	—	24	50	pF

(continued)

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H21B1, H21B2, H21B3, H22B1, H22B2, H22B3

ELECTRICAL CHARACTERISTICS — continued (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OUTPUT DARLINGTON						
Dark Current (V_{CE} = 25 V)		I_{CEO}	—	10	100	nA
Collector-Emitter Breakdown Voltage (I_C = 1 mA)		$V_{(BR)CEO}$	30	90	—	Volts
Emitter-Collector Breakdown Voltage (I_E = 100 μA)		$V_{(BR)ECO}$	7	—	—	Volts
Capacitance (V_{CE} = 5 V, f = 1 MHz)		C_{CE}	—	4	—	pF
DC Current Gain (V_{CE} = 10 V, I_C = 2 mA)		h_{FE}	—	10,000	—	—
COUPLED (Note 1)						
Output Collector Current (I_F = 2 mA, V_{CE} = 1.5 V)	H21B1, H22B1	I_C	0.5	1	—	mA
	H21B2, H22B2		1	2	—	
	H21B3, H22B3		2	3.8	—	
Output Collector Current (I_F = 5 mA, V_{CE} = 1.5 V)	H21B1, H22B1	I_C	2.5	5	—	mA
	H21B2, H22B2		5	10	—	
	H21B3, H22B3		10	18	—	
Output Collector Current (I_F = 10 mA, V_{CE} = 1.5 V)	H21B1, H22B1	I_C	7.5	15	—	mA
	H21B2, H22B2		14	28	—	
	H21B3, H22B3		25	40	—	
Collector-Emitter Saturation Voltage (I_C = 1.8 mA, I_F = 10 mA)		$V_{CE(sat)}$	—	—	1	Volts
Collector-Emitter Saturation Voltage (I_C = 50 mA, I_F = 60 mA)	H21B2, H22B2	$V_{CE(sat)}$	—	—	1.5	Volts
	H21B3, H22B3		—	—	1.5	
Turn-On Time (I_F = 10 mA, V_{CC} = 5 V, R_L = 510 Ω)		t_{on}	—	120	—	μs
Turn-Off Time (I_F = 10 mA, V_{CC} = 5 V, R_L = 510 Ω)		t_{off}	—	500	—	μs

Notes 1. Stray radiation can alter values of characteristics Adequate light shielding should be provided
2. No actuator in sensing gap

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TYPICAL CHARACTERISTICS

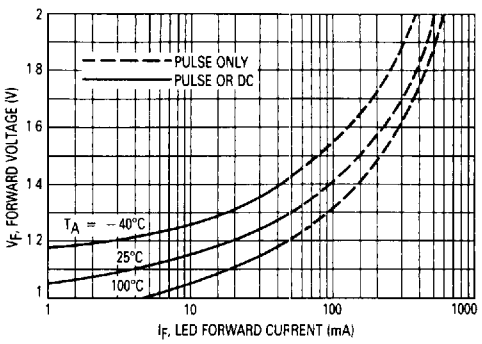

Figure 1. LED Forward Voltage versus Forward Current

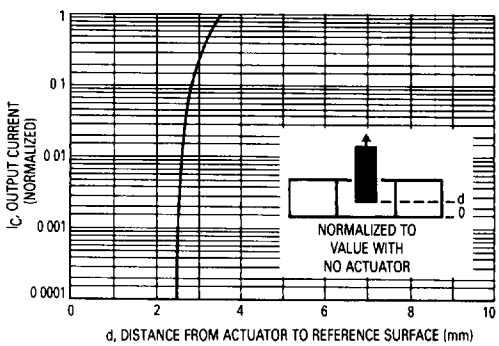

Figure 2. Output Current versus Actuator Position

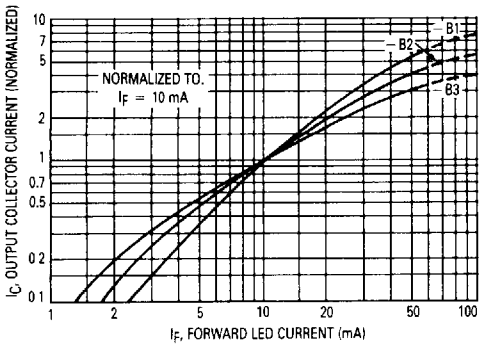

Figure 3. Output Current versus Input Current

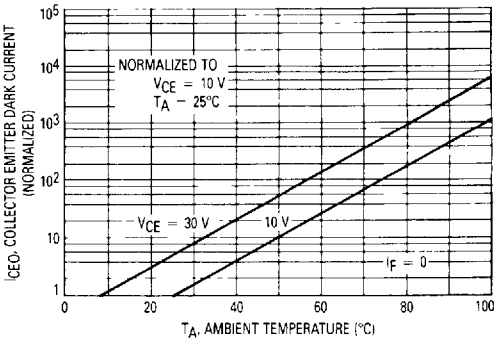

Figure 4. Collector-Emitter Dark Current versus Ambient Temperature

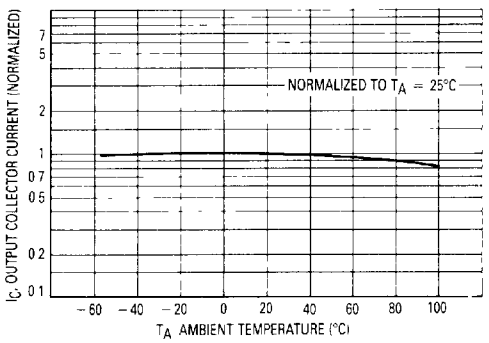

Figure 5. Output Current versus Ambient Temperature

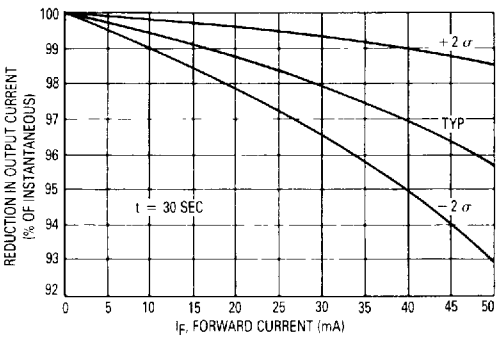

Figure 6. Reduction in Output Current Due to LED Heating versus Forward Current

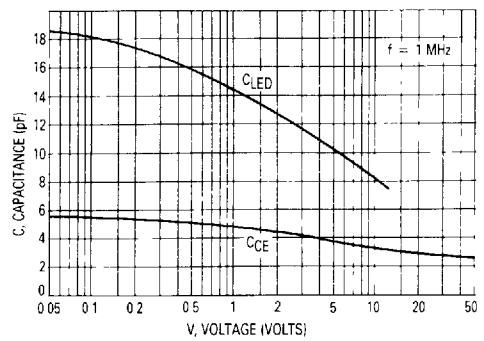

Figure 7. Capacitances versus Voltage

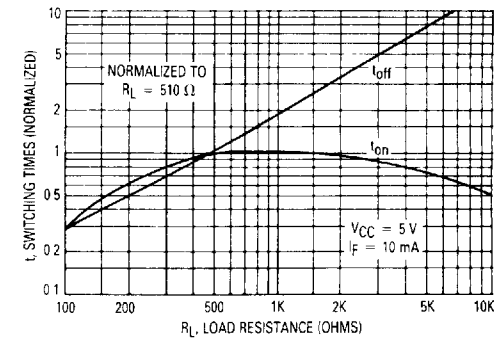

Figure 8. Switching Times versus Load Resistance

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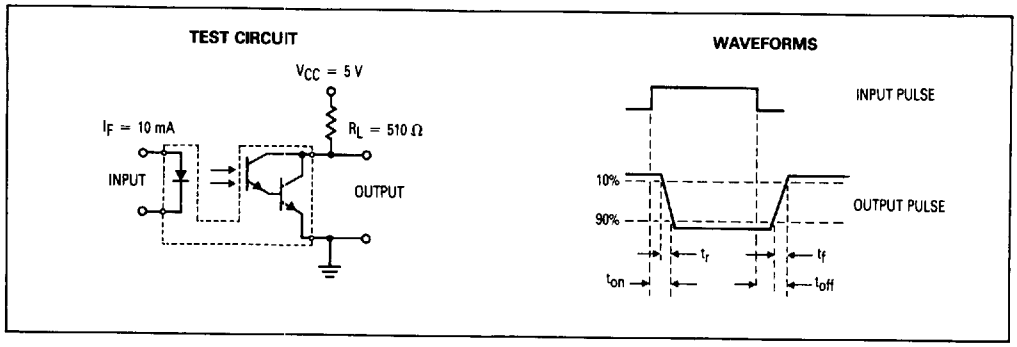

Figure 9. Switching Times

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